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Ratooned S × P Cotton

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INTRODUCTION

Ratooned cotton[1] is grown to a limited extent in many of the warmer cotton-growing regions, although the great bulk of the world crop is produced by annual seeding. Cold winters prevent ratooning in the main Cotton Belt of the United States, but in some warm valleys of the Southwest the winters are often mild enough to allow a second crop to be grown from the stubble.

In 1941, heavy spring rains so seriously interfered with planting operations in Arizona that cotton growers ratooned approximately one-fifth of the acreage. This circumstance afforded an excellent opportunity to investigate some of the characteristics of ratooned cotton. Consequently, seed cotton samples of both ratooned and annual S × P, an American Egyptian variety of *Gossypium barbadense* L., were collected for laboratory analysis. The results are here discussed.

S × P cotton is used extensively in the manufacture of military fabrics, and the better grades and staples are controlled by a conservation order of the War Production Board. Since much of the 1943 crop is being grown from ratooned plants, the quality of cotton thus produced is of considerable practical importance.

The writers are not aware of previous research on ratooned cotton in the United States, with the exception of a spinning test by The American Thread Co. on the 1914 crop of American Egyptian (Yuma variety) from the Salt River Valley, Ariz., and Durango upland cotton (*G. hirsutum* L.) from Imperial County, Calif.[2]

[1] Sometimes referred to as "stubbed" or "volunteer" cotton.

[2] In a letter to C. S. Scofield, dated October 8, 1915, E. W. Barnard, of The American Thread Co., stated that the ratooned Yuma cotton showed no marked inferiority, but that the ratooned Durango was very inferior to the annual growth of that variety.

SUMMARY

Seed cotton samples of ratooned S × P cotton, collected in 1941 from 33 fields in southern Arizona, differ significantly from comparable samples of the annual crop in respect to the means of all the characters measured, and in nearly all characters they show a tendency toward greater variability.

The ratooned cotton has smaller, fewer seeded bolls, and smaller, less fuzzy, more abundantly linted seeds. The fiber is slightly stronger and finer, but imperfections are of somewhat more frequent occurrence than in the annual growth.

The outstanding advantage of the ratooned product is the higher lint percentage, and the principal disadvantage is the relatively short fiber.

Ratooned cotton flowers several weeks earlier than annual plantings and therefore develops its crop under different conditions in respect to weather and prevalence of destructive insects. Under favorable conditions, ratooned S × P may outyield the annual by a wide margin, as in Maricopa County in 1941, but poor stands and insufficient or improper irrigation sometimes materially curtail the yields.

A definite tendency toward stronger correlation of characters is observed in the ratooned cotton. Five coefficients of correlation are significantly larger in the ratooned series, and 18 of the 36 pairs of characters are significantly correlated, as compared with only 12 correlated pairs in the annual samples.

The differences noted between the ratooned and annual growths in respect to staple length, lint percentage, and yield must be considered of primary economic importance. On the other hand, the quality of the fiber appears to be very similar in other respects, and it is doubtful whether much practical significance should be attached to the small differences found in such fiber properties as fineness, strength, and frequency of microscopic imperfections.

REVIEW OF THE LITERATURE

Templeton (*22*)[3] worked in Egypt with several varieties of Egyptian cotton (*Gossypium barbadense* L.). A spinning test showed that the first, second, and third ratooned crops of Sakel produced stronger yarns than the corresponding first-year crops. In a similar experiment with Zagora, the results were partially reversed, the annual crops having produced stronger yarns in the first 2 years of the 3-year experiment. As to yield, the ratooned plots of Zagora averaged 5.15 kantars (1 kantar=99.05 pounds) per feddan (1.038 acres) in 1924 and 5.05 kantars in 1925, as compared with 2.02 and 3.16 kantars in comparable annual plots. In 1926 the ratooned plots of Sakel averaged 4.52 kantars per feddan, whereas the annual plots yielded 1.84 kantars. In five experiments conducted at Giza the ratooned plots gave very superior yields, and a spinning test on Sakel from one of the experiments showed that the ratooned fiber was stronger.

Templeton concluded that the "scanty evidence on the question of quality seems to indicate that the lint from plants in their second year is, on the whole, not appreciably inferior, if at all, to that pro

[3] Italic numbers in parentheses refer to Literature Cited, p. 10.

duced in their first. The yield is invariably stated to be higher in the second." In his opinion, considerable acreage in Egypt would be under perennial cultivation were it not for the Government order of 1912 prohibiting ratooning.

Miège (*13*) considered the results of ratooning to have been almost uniformly favorable in Morocco. Testing samples of annual and ratooned Lone Star (*G. hirsutum* L.) and Pima (*G. barbadense* L.) furnished by Miège, Heim de Balsac (*8*) found that in both cottons the fiber of the ratooned growth was longer, stronger, and finer than that of the first-year crop.

The properties of ratooned Durango upland cotton (*G. hirsutum* L.) grown in Queensland were studied by Summers (*20*), who ascertained that the raw fiber was shorter, thinner walled, weaker, and finer (as measured by weight per centimeter) than the fiber of the first crop. When mercerized, the difference in wall thickness was reduced from 14.5 percent to less than 1 percent. The strength of the raw fiber of the ratooned Durango was 15.5 percent less than that of the annual, but when mercerized it became 7.1 percent stronger.

Evans (*3*) viewed ratooning of Durango and Acala upland cottons as generally unsatisfactory in Queensland, from the standpoint of both yield and quality. The ratooned growth inclined toward smaller bolls and seeds, the lint percentage was definitely lower, and "the spinners and manufacturers were almost equally unanimous in their opinion that the ratoon was inferior to the annual."

Many comments on perennial culture appear in Pearse's book on Brazilian cotton (*15*). The relation of insect pests to ratooning is treated by a number of writers, among whom are Bishara (*1*), Evans (*3*, *4*), Jenkins,[4] McDonald,[5] Miège (*13*), and Rosenfeld and Jones (*18*). Various viewpoints on ratooning are expressed by Harland (*7*), Jones (*9*), McLachlan (*11*), Oosthuizen (*14*), Scofield and others (*19*), Templeton (*21*, *22*), and Thompson and Crider (*23*).

PLANT BEHAVIOR AND YIELD

Ratooned S × P is distinguished from the annual by a more bushy habit of growth, owing to the development of a number of vegetative branches and the suppression of a definite axial stem. Ultimately, the ratooned plants attain less height than plants of the seeded crop grown under similar conditions.

The ratooned cotton, developing rapidly from stumps of the previous season's growth, flowers several weeks earlier than annual plantings. The bolls mature under different weather conditions, the temperature usually being higher and the relative humidity lower during development of the ratooned crop. Also, in Arizona the maximum incidence of destructive insects normally does not occur until after the ratooned cotton sets a major part of its crop. These are factors that may conceivably affect both the yield and the quality of ratooned S × P cotton.

Observations made in the vicinity of Gilbert, Ariz., on June 24, 1941, show that the total leaf areas of a representative plant each of ratooned

[4] JENKINS, W. H. SEA-ISLAND COTTON IN PUERTO RICO AND ITS RELATION TO PRODUCTION IN THE CONTINENTAL UNITED STATES. Puerto Rico Agr. Expt. Sta. Agr. Notes 71: 1–9. 1936. [Processed.]

[5] MCDONALD, R. E. INFORMATION FOR THE CITIZENS OF ARIZONA ABOUT THE PINK BOLLWORM INFESTATION IN THE SALT RIVER VALLEY, AND SOUTH. U. S. Dept. Agr., Bur. Ent. and Plant Quar., 3 pp., Nov. 28, 1936. [Processed.]

and annual S × P were 3,856 and 906 square inches, respectively, a ratio of 4.25 to 1.00. Likewise, the root systems of ratooned plants in that locality, evidently having survived practically intact from the previous growing season, were found to be far more extensive than those of annual plants. The water requirement of ratooned cotton has not been investigated, but it seems evident from the observations noted above that ratooned plantings in Arizona need special irrigation management, or at least more water in the early part of the growing season than is usually given annual plantings.

Unfortunately, it was not practicable to ascertain the yields of the particular fields from which samples were collected, but other data indicate that in 1941 the ratooned S × P outyielded the annual plantings. In Maricopa County, Ariz., the average yield of 60 fields of ratooned cotton, comprising 2,878 acres, was 219.5 pounds of lint per acre. An equal number of fields of annual S × P, comprising 5,191 acres, averaged 165.0 pounds.[6] The difference amounts to 33 percent and is highly significant, being 3.8 times its error.

MATERIAL, DEFINITIONS, AND LABORATORY METHODS

Samples were collected from 33 fields of ratooned S × P cotton, the sample representing each field consisting of 50 bolls of seed cotton. In each instance, a comparable sample was obtained from the nearest field of annual S × P, in nearly all cases less than 1 mile distant. The samples represent the S × P variety as grown under irrigation in the agricultural valleys along the lower reaches of the Gila and Salt Rivers in Arizona.

TABLE 1.—*Comparison of annual and ratooned S × P cotton from 33 fields, southern Arizona, 1941*

Character	Annual		Ratooned		Difference between means (annual minus ratooned)	Difference required for significance [1]
	Mean	Coefficient of variation	Mean	Coefficient of variation		
Bolls per pound of seed cotton---number--	140.2	10.1	156.2	16.8	−16.0	13.8
Seeds per boll---number--	17.55	9.0	16.43	9.7	+1.12	1.04
Seed index	13.25	6.0	12.23	6.5	+1.02	.52
Seed-fuzz index	.578	25.6	.389	28.6	+.189	.090
Lint percentage	28.85	5.1	32.00	6.4	−3.15	1.17
Lint index	5.37	8.5	5.80	13.1	−.43	.41
Fiber length:						
Upper quartile---decimal inches--	1.4802	3.9	1.4376	3.1	+.0426	.0335
Staple length---1/32 inch--	49.15	3.1	46.39	3.2	+2.76	.99
Fiber-strength index [2]	9.756	4.0	10.076	9.1	−.320	.223
Fiber fineness [2]--micrograms per inch of fiber--	3.652	6.0	3.575	6.8	+.077	.074

[1] Odds of 99 to 1.
[2] 4 observations per sample.

The number of bolls per pound of seed cotton (table 1) is a negative expression of boll size, as measured by content; that is, the more bolls per pound the smaller the bolls. For this reason, in table 3 (p. 8), where the character is termed boll size, the signs of the coefficients

[6] Data available through courtesy of the Maricopa County Committee, Agricultural Adjustment Agency.

of correlation are reversed, thus lending the character its true meaning.

Seed index is the weight, in grams, of 100 seeds, ginned but otherwise untreated.

Seed-fuzz index is the weight, in grams, of the fuzz on 100 ginned seeds. The character, which is analogous to lint index, was calculated from the difference in weight of a known number of seeds before and after delinting with concentrated sulfuric acid.

Lint index is the weight, in grams, of the fiber on 100 seeds.

Fiber length was determined by stapling and also by means of the Pressley mechanical fiber sorter. This machine operates on the principle of the hand-sorters described by McNamara and Stutts (*12*) and by Pressley (*16*). All these sorters require seed cotton, but the mechanical sorter automatically removes and accumulates the fiber in classes of uniformly decreasing length. From fiber arrays so obtained, the length of sorted fiber at the upper quartile (25 percent point) was calculated by the usual formula (*24*).

Fiber-strength index is defined by Pressley (*17*). In every series of strength tests, several subsamples of an S × P standard sample were included, and the fiber-strength indexes of the ratooned and annual samples were adjusted in proportion to the average index of the standard. All tests were made on the Pressley cotton fiber-strength tester (*17*).

The character designated fiber fineness in table 1 is the weight, in micrograms, of a single fiber 1 inch in length, calculated from the weight of 300 fibers that were cut to a uniform length of 0.46 inch.[7] Owing to greater waviness of the fibers, the weights obtained by this method are appreciably greater than those obtained when fibers are taken from a hand-sorted array, but the results are believed to be equally dependable. Since fineness increases as the weight per inch of fiber decreases, the signs of correlation coefficients involving fiber fineness (table 3) are reversed, thus giving the term fineness its true meaning.

The size of a difference required for significance between means (table 1) and between coefficients of correlation (table 3) was estimated by reference to the table on distribution of t given by Fisher and Yates (*6*). Coefficients of correlation were calculated by the usual formula, and the value of r required for significance was found in the table prepared for that purpose by Fisher and Yates (*6*).

SEED COTTON, SEED, AND FIBER CHARACTERS

The comparative results obtained by laboratory analysis of seed cotton samples of ratooned and annual S × P cotton are summarized in table 1. The difference between the means of the two series of samples is, for each character, sufficiently large to be significant at odds of at least 99 to 1. All the differences, therefore, may be considered statistically significant.

The larger number of bolls per pound of seed cotton shows that the ratooned cotton has appreciably smaller bolls than the annual. The respective means are 156.2 for the ratooned samples and 140.2

[7] Fineness counts were made by A. B. Herring, Jr., junior agronomist, and Ruby S. Parker, laboratory assistant, Division of Cotton and Other Fiber Crops and Diseases.

bolls for the annual cotton. The difference is 16 bolls per pound, or 11.4 percent.[8]

The ratooned S × P has 6.4 percent fewer seeds per boll than the annual, the means being 16.43 seeds for the ratooned and 17.55 for the annual cotton. Not only are there fewer seeds per boll in the ratooned cotton but they are 7.7 percent smaller, as indicated by the seed index. The mean seed index of the ratooned series of samples is 12.23, as compared with a mean of 13.25 in the annual series.

Seeds of the ratooned S × P are, on the average, remarkably less fuzzy than those of the annual growth, the difference in quantity of fuzz amounting to 32.7 percent. The means for seed-fuzz index in the ratooned and annual samples are 0.389 and 0.578, respectively. The coefficients of variation for seed-fuzz index (table 1) indicate extreme variation among samples, possibly reflecting a certain degree of error in technique as well as actual variation in seed fuzziness.

The most favorable characteristic of the ratooned product, from the growers' standpoint, is the high lint percentage, 32.00 percent as compared with 28.85 percent in the annual samples. This difference between the means amounts to 10.9 percent. In the samples from the 33 fields of ratooned cotton, only 4 had a gin outturn of less than 30 percent. In contrast, the lint percentage was less than 30 percent in 27 of the 33 samples of the annual growth.

The lint index of the ratooned samples averages 5.80, whereas the mean is 5.37 in the annual series. The difference of 0.43 amounts to 8 percent.

The fiber of the ratooned samples is significantly shorter by both methods employed to determine fiber length. The means of length at the upper quartile in the ratooned and annual series are, respectively, 1.4376 and 1.4802 inches. The mean staple length of the ratooned is 46.39/32 inches, of the annual 49.15/32 inches. The difference of nearly 3/32 inch in staple length amounts to 5.6 percent and is by far the most serious disadvantage of the ratooned product. Furthermore, the fiber stapled less than 1½ inches in 26 of the 33 samples from ratooned fields, as compared with only 3 samples of the annual cotton with fiber so short.

The ratooned S × P produced fiber that averages only 3.3 percent stronger than the fiber of the annual growth, as indicated by the Pressley fiber-strength index, but the difference is highly significant. The means for fiber-strength index of the ratooned and annual samples are 10.076 and 9.756, respectively. The respective means for the X-ray angle of the ratooned and annual samples (not given in table 1) are $31.51 \pm 0.233°$ and $33.53 \pm 0.234°$.[9] The difference of $2.02 \pm 0.330°$ is statistically very significant. Since fiber strength is inversely proportional to the X-ray angle (*2*), the smaller mean angle of the ratooned cotton is indicative of greater strength.

The samples of ratooned cotton have slightly finer fiber, the mean number of micrograms per inch of fiber being 3.575, as compared with 3.652 micrograms for the annual cotton. Although this difference is very small, amounting to only 2.1 percent, it is significant at odds of 99 to 1 and, therefore, may represent an intrinsic difference in the fiber fineness of the two growths.

[8] The difference is expressed as a percentage of the annual cotton mean, a procedure that is followed throughout this circular.

[9] X-ray angles determined by Earl E. Berkley, cotton technologist, Division of Cotton and Other Fiber Crops and Diseases.

FIBER IMPERFECTIONS [10]

Fiber imperfections that are believed sometimes to result in the formation of neps are, in order of importance, immaturity (walls very thin), extreme tapering of the distal end, deformities, irregular diameter, surface roughness, and constrictions. The relative frequency of these imperfections in neps found in yarns of cottons grown, ginned, and spun under uniform conditions is the basis for placing them in the particular order here given. Although the yarn studies to date have not included the S × P variety, the imperfections have occurred in the indicated order in all varieties that have been examined. Certain fiber abnormalities are illustrated and discussed by Farr (*5*).

Variation in the frequency of fiber imperfections within a uniform variety, such as S × P, is often associated with variation in soil moisture conditions. For instance, high percentage of immaturity may be associated either with a deficiency or an excess of soil moisture, although in the light of present knowledge the former condition is more important. The evidence available at this time points to adverse growing conditions as the primary cause of all the other imperfections noted in table 2, except deformities, which appear to be mainly varietal in nature.

TABLE 2.—*Imperfections observed in mercerized fibers from 22 samples each of ratooned and annual S × P cotton in southern Arizona, 1941* [1]

Kind of cotton	Mean percentages of fibers showing—		Number of samples showing—			
	Immaturity	Deformities	Extreme tapering	Irregular diameter	Roughness	Constrictions
Annual	7.35	5.30	11	17	14	14
Ratooned	9.45	5.65	18	20	20	18

[1] The number of fibers examined per sample averaged 265 (range, 131 to 1,163).

The criterion of immaturity employed in this analysis is the failure of a fiber to relinquish its convolutions when immersed in an 18-percent solution of sodium hydroxide. The larger percentage of immature fibers observed in the ratooned samples (table 2) may account in some measure for the greater strength index of the ratooned cotton (table 1).

The results of the microscopic examination of fiber samples representing ratooned and annual S × P are summarized in table 2. Since all the imperfections occur with greater frequency in the ratooned series of samples, the presumption is that yarns spun from the ratooned cotton would be inclined to contain more neps than yarns made from the annual growth.

CORRELATION OF CHARACTERS

In order to detect any additional differences in the reactions of the ratooned and annual growths, coefficients of simple correlation (r) were calculated for all possible combinations of characters (table 3), exclusive of fiber imperfections.

In the ratooned series, 18 pairs of characters, or half the total number of combinations, are more or less significantly correlated, as compared with only 12 correlated pairs in the annual series. Further-

[10] Contributed by George J. Harrison, agronomist, Division of Cotton and Other Fiber Crops and Diseases.

TABLE 3.—*Coefficients of correlation for all combinations of 9 characters of S × P cotton from 33 fields each of annual and ratooned growth, southern Arizona, 1941*

Paired characters	Coefficient of correlation [1]		Difference [2]
	Annual	Ratooned	
	r	*r*	
Boll size and—			
Seeds per boll	+0.796	+0.899	0.103±0.073
Seed index	+.421	+.627	.206± .180
Seed-fuzz index	−.235	−.432	.197± .221
Lint percentage	+.205	+.724	.519± .189*
Lint index	+.485	+.812	.327± .148*
Fiber length [3]	+.268	+.246	.022± .233
Fiber strength	−.124	+.027	.151± .248
Fiber fineness	−.663	−.422	.241± .178
Seeds per boll and—			
Seed index	−.160	+.296	.456± .236
Seed-fuzz index	−.226	−.393	.167± .225
Lint percentage	+.083	+.589	.506± .210*
Lint index	−.005	+.561	.566± .214*
Fiber length	+.142	+.313	.171± .235
Fiber strength	+.057	+.023	.034± .250
Fiber fineness	−.440	−.327	.113± .213
Seed index and—			
Seed-fuzz index	+.191	−.079	.270± .245
Lint percentage	−.137	+.396	.533± .228*
Lint index	+.556	+.753	.197± .144
Fiber length	+.329	−.048	.377± .237
Fiber strength	−.368	−.132	.236± 232
Fiber fineness	−.382	−.214	.168± .227
Seed-fuzz index and—			
Lint percentage	−.616	−.705	.089± .141
Lint index	−.354	−.550	.196± .198
Fiber length	−.036	+.142	.178± .248
Fiber strength	−.191	−.525	.334± .213
Fiber fineness	+.269	+.217	.052± .235
Lint percentage and—			
Lint index	+.736	+.884	.148± .090
Fiber length	−.241	+.049	.290± .242
Fiber strength	+.224	+.219	.005± .238
Fiber fineness	−.278	−.598	.320± .198
Lint index and—			
Fiber length	+.041	−.010	.051± .250
Fiber strength	−.051	+.080	.131± .249
Fiber fineness	−.495	−.528	.033± .184
Fiber length and—			
Fiber strength	−.015	−.310	.295± .239
Fiber fineness	−.291	−.389	.098± .221
Fiber strength and fiber fineness	+.113	−.028	.141± .249

[1] Values of *r* required for significance at odds of 99 to 1 and 19 to 1, respectively, are ±0.449 and ±0.349.
[2] Values of *t* (difference/error) required for significance at odds of 99 to 1 and 19 to 1, respectively, are 2.66 and 2.00. Asterisk (*) indicates a significant difference.
[3] In this table correlations involving fiber length are based on length at the upper quartile (25-percent point), not on staple length.

more, the coefficients, irrespective of sign, average 0.376 in the ratooned and only 0.284 in the annual samples. The correlation coefficients in the two series differ significantly in the following 5 combinations: Boll size and lint percentage, boll size and lint index, number of seeds per boll and lint percentage, number of seeds per boll and lint index, and seed index and lint percentage.

Fiber length, as measured by the length of sorted fiber at the upper quartile, appears to be independent of all other characters in the annual series of samples, but in the ratooned cotton there is a weak negative correlation with fiber fineness ($r=-0.389$).[11] The value of the coefficient of correlation for staple length and fiber strength in the ratooned cotton (not shown in table 3) is −0.564, a highly significant negative correlation. Also, in the ratooned series, there is a barely significant negative correlation between staple length and seed-fuzz index ($r=-0.396$). The coefficients of correlation for staple length and length at the upper quartile are only +0.567 in the ratooned series

[11] Values of *r* required for significance are given in table 3, footnote 1.

and +0.460 in the annual. Although these coefficients are statistically very significant, it is natural to expect much stronger correlation between such essentially similar characters as staple length and length at the upper quartile. Imperfect stapling may account in some measure for the lack of a stronger correlation.

The absence of correlation between fiber strength and fiber fineness is of some interest, especially in view of the fact that the fiber of the ratooned cotton averages both finer and stronger than the fiber of the annual growth.

DISCUSSION

The laboratory tests show that the ratooned S × P differs from the annual growth in respect to the means of all the characters studied, and that it is evidently more variable, as indicated by the larger coefficients of variation for all characters except fiber length at the upper quartile (table 1).

Although the yield of S × P is known to have been exceptionally low in 1941, there is no evidence of serious seasonal aberrance in the quality of that year's crop. On the contrary, the means of six characters in the samples of annual cotton (table 1) do not differ significantly from corresponding means given by Kearney, Peebles, and Smith (*10*) in dealing with annual S × P cotton grown at several localities over a period of 12 years. The characters that it is possible to compare are number of bolls per pound of seed cotton, number of seeds per boll, seed index, lint percentage, lint index, and fiber length. The largest difference between comparable means in the two independent investigations occurs in seed index, but that difference is only 1.8 times its error, consequently is not statistically significant.

Much research has been directed toward determining what characters are correlated in commercial cotton varieties and in segregating populations, but the present work is probably unique in that the samples were collected from a single relatively stable variety grown under a wide range of cultural and other environmental conditions.

High values for the correlation coefficients in both the ratooned and annual series of samples point strongly to the existence of a genuine correlation of the characters. Conversely, very low values in both series almost preclude the possibility of a true correlation. Where a large coefficient occurs only in one series (e. g., seeds per boll and lint percentage) there is a question whether the result occurs in response to an actual difference in the behavior of the ratooned and annual growths or to chance distribution. In respect to the five pairs of characters noted in table 3, however, as having significantly different coefficients in the two series of samples, an assumption of a difference in the behavior of the ratooned growth would be supported by the fact that in every instance either of two highly interdependent characters, namely, lint percentage and lint index, is involved. Furthermore, the ratooned cotton shows a definite tendency toward stronger correlation of characters, both as to the number of significantly correlated characters and the magnitude of the coefficients.

Although the ratooned and annual S × P differ significantly, according to statistical tests, in respect to the means of all the characters measured, the quality of the fiber appears to be very similar in many respects, and it is perhaps doubtful whether much practical impor-

tance should be ascribed to the small differences found in such fiber characters as fineness, strength, and frequency of imperfections. Seed cotton characters, including boll size, number of seeds per boll, seed index, seed-fuzz index, and lint index, although of interest to cotton breeders and other students, have practical significance mainly in their relation to picking characteristics, lint percentage, and rate of ginning. On the other hand, the presence of large differences between the ratooned and annual growths in respect to staple length, lint percentage, and yield must be recognized as of primary importance.

The high lint percentage and the superior yield observed in 1941 strongly favor the ratooned S × P, as both these characteristics result in financial benefit to the growers. On the other hand, the shorter staple length results in a lower market price and undoubtedly restricts the utilization of the ratooned cotton. Since the data on yield pertain to one season only, it would be unwise to conclude that ratooned S × P consistently outyields annual plantings. High yield is predicated on reasonably good stands, but under Arizona conditions survival in the ratooned fields is sometimes so poor as to preclude profitable yields. Also, ratooned yields are often severely curtailed by insufficient or improper irrigation.

The prejudice that appears to exist in the cotton textile trade against S × P that is appreciably shorter than average should not apply to ratooned S × P merely on account of its shorter staple length. In annual S × P, short and weak fiber usually characterizes the late-season crop, which often comes from frosted bolls. Ratooned cotton, however, matures mainly before frost, and the only undesirable feature it shares with the late-season annual cotton is its relatively short fiber. As to strength, instead of the ratooned S × P being weak, as commonly believed, the tests show the fiber actually to be somewhat stronger than fiber of the first crop.

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